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FIELD EXPERIMENTS, 1906-8.

CONTENTS. PAGE

Experiments with fertilizers on potatoes.............. 85
High ridge vs. modified ridge culture for potatoes.... 88
Blight resistant varieties of potatoes............... 92
Target Brand Fungicide 96
Alfalfa 98
Wild mustard........................... 100
Lime in seeding down....................... 101

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BULLETIN No. 167.

FIELD EXPERIMENTS IN 1906-8.

CHAS. D. WOODS AND J. M. BARTLETT.

In addition to the field experiments conducted by the Plant Pathologists of the Station and reported in bulletins 149 and 164 a number of cooperative field experiments were planned and carried out by the writers during the years 1906-8. Some of these experiments, notably, test of varieties of potatoes for blight resistance and yield and a modified ridge *versus* the high ridge culture ordinarily practiced in Aroostook County are to be continued.

EXPERIMENTS WITH FERTILIZERS ON POTATOES IN 1906.

The object of this experiment was to compare home mixed fertilizers with ready mixed goods using the same amount of plant food as nearly as possible in each case.

The field selected for the purpose was on the "Kenney Farm," so called, about 3 miles from Houlton village and planted this season by Mr. W. S. Blake through whose courtesy the Station was allowed to make its experiment. The field was an old one and had been cultivated for many years and this season was planted to potatoes for the second crop since the land was in grass, the piece yielding about 100 barrels to the acre in 1905. The land was high, naturally well drained and the soil was somewhat finer than most of the potato lands, quite free from stone and apparently sufficiently uniform to make the different plots favorable for comparing different kinds of fertilizers. Fourteen acres were used in all for the experiment, being divided into plots of one acre each.

For a mixed fertilizer Watson's High Grade Potato Fertilizer was used and the home mixed goods were made according to the following formulas.

Home mixed formulas used for one acre in 1906.

INGREDIENTS.	NUMBER OF FORMULA.			
	1	2	3	4
	Pounds.	Pounds.	Pounds.	Pounds.
Nitrate of soda	100	175	100	100
Screened tankage	200	400	–	200
Dried blood	160	–	300	160
Acid phospate	600	600	600	600
Sulphate of potash	160	160	160	320

Plant food per acre furnished by fertilizer used in 1906.

	Nitrogen.	Phosphoric Acid.		Potash.
		Available.	Total.	
	Pounds.	Pounds.	Pounds.	Pounds.
Formula No. 1	48	98	122	80
Formula No. 2	48	112	154	80
Formula No. 3	48	84	90	80
Formula No. 4	48	98	122	160
Watson's Improved	48	108	150	76

The field was planted May 19-26 to Green Mountain potatoes and about two-thirds of the fertilizer used, 1000 lbs. of the Watson and 800 lbs. of the home mixed to an acre, was applied at this time. On June 11 to 14 when the potatoes were just breaking the ground the remainder of the fertilizer was put on, making up the plant food equivalent to 1500 lbs. of Watson's fertilizer or in round numbers about 45 pounds of nitrogen, 90 pounds available phosphoric acid and 80 pounds of potash except on plot 14, where the potash was doubled making 160 pounds to the acre. The second application was made with the potato planter, the plow being removed. During the growing season the field was thoroughly tilled and sprayed but suffered considerably from the hot dry weather in August and early September, which stunted the growth of the tubers. On September 14th harvesting was begun as more than half of the tops were dead and growth of tubers had practically ceased. No late blight or rot was found on the piece.

The yield of tubers for the different plots are shown in the following table. The variations in the yields is chiefly due to slight variations in the soil of the plots, as for instance No. 5 was on the highest portion of the field and suffered a little more from drought than its neighbors and No. 12 contained a low wet spot which reduced the yield.

Arrangement of acre plots and yield of merchantable potatoes per acre.

Number of Plot.	Kind of Fertilizer.	Yield of Potatoes. bbls.*
1	Watson's	89
2	Formula No. 1	89
3	Watson's	91
4	Formula No. 2	90
5	Watson's	86
6	Formula No. 3	98
7	Watson's	101
8	Formula No. 1	102
9	Watson's	98
10	Formula No. 2	100
11	Watson's	98
12	Formula No. 3	91
13	Watson's	103
14	Formula No. 4	105

Average yield with Watson's improved	95	barrels per acre
Average for formula No. 1	95½	barrels per acre
Average for formula No. 2	95	barrels per acre
Average for formula No. 3	94½	barrels per acre
Average for formula No. 4	105	barrels per acre

Formula No. 4 with double the amount of potash gave 10 bbls. more potatoes than the average but the increase in yield cannot be attributed to the extra potash but more properly to the soil of the plot which was about the best in the field for a dry season and it will be noticed that No. 13 yielded only 2½ barrels less and it was not quite so good a plot as regards location.

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* One barrel equals 2.75 bushel.

HIGH RIDGE VS. MODIFIED RIDGE CULTURE FOR POTATO GROWING.

The method of ridge culture is almost universally used by potato growers in Aroostook County. Probably over 90 per cent of the farmers practice what might be called extreme ridge culture, that is, the ridging begins at the time of planting. The planter most used has a plow so constructed that it makes little more than a mark on the soil unless it is very light, instead of a furrow, then the disks at the rear of the machine cover the seed by throwing up a ridge perhaps four inches high so that the seed at the very start is practically on a level with the surface between the rows. A few farmers make a practice of going over the field with a weeder and somewhat flattening the ridge but the number that do this is comparatively few. The method most usually followed is to go between the rows with the cultivator perhaps 8 to 10 days after the potatoes are planted and then as soon as they begin to break the ground go over with the horse-hoe and bury them up also burying the weeds at the same time and thereby raising the height of the ridge. This kind of cultivation is continued until the tops are too large to pass through without injury. By this time an A shaped ridge has been formed about 12 to 15 inches high and, of course, the surface between the rows has been dropped by the continual scraping up of the dirt so that the tubers growing in the ridge are considerably above the surface between the rows.

It can be readily seen that in a dry season a field so handled must suffer considerably from lack of moisture. Of course, in a wet season as is frequently experienced in Aroostook County no lack of moisture is felt and the drains between the rows are an advantage rather than an injury but in an extremely dry season it would seem that the drainage is too great. The ridges being high and narrow dry out very quickly and it would appear therefore the crop must suffer more from lack of moisture than it would if the roots of the plants were below the level as they are when modified level culture is practiced.

The two dry seasons of 1905 and 1906 were somewhat disastrous to potato fields cultivated with the high ridge and the crop was considerably below a normal crop in the dry sections of the county. For this reason the experiments here reported were undertaken in 1907 for the purpose of comparing a more nearly level culture such as is practiced in southern New England and some dryer sections of the country with the ridge method common in Aroostook County.

Mr. Oscar A. Benn who lives a short distance out of Houlton has practiced a modification of a ridge and level culture for several years and reports it as successful. He plants the seed as deep as possible with a Robbins planter and keeps the field free from weeds by frequently going over it with the weeder, in three different directions—crosswise, lengthwise and diagonally. In this way he claims to keep the weeds down during the first stages of growth without injury to the plants more cheaply than he can by the ridge method. The weeder is used until the plants get too high for a weeder, then the cultivator is run between the rows until the plants are 8 to 9 inches high. At this time the horse hoe is used to throw up a low ridge which is broader and flatter on the top than the ordinary ridge and is not more than half as high. The horse hoe is used only once and this is usually the final hoeing of the field. Mr. Benn claims that the potatoes are more easily taken care of by this method; more easily harvested, and in a season that is at all dry, better crops are obtained than by the method of ridging.

The experiments here reported were carried on practically by Mr. Benn's method. It was not thought best to attempt to use strictly level culture as the planter in common use in the county does not put the seed sufficiently deep for a perfectly level culture and it was not thought that potatoes could be as easily harvested by the digger that is in common use.

EXPERIMEKNT IN 1907.

The season of 1907 proved an extremely wet one and unfavorable for this experiment so that the modified method of ridge culture could not be strictly followed. Six acres on the farm of Mr. John Watson, Houlton, were given to the experiment, three acres being used alternately for the modified ridge and three check plots were cultivated by the method of high ridge.

The piece was planted May 24 and 25 and a few days after the weeder was run crosswise over the field which very nearly leveled the ground on the level culture plots and left the potatoes covered about 3 inches. Five days later, the level culture plots were again gone over lengthwise with the weeder and June 10 the weeder was run lengthwise over them. In the meantime it had been found necessary to run the cultivator between the rows. June 10 the potatoes were just appearing above the surface of the ground and on account of abundant rains they grew very rapidly and the tops were so tender that it was not deemed wise to again run the weeder through them and cultivation was restricted to hand hoes and cultivation between the rows. Two hand hoeings were deemed necessary for these plots. When the tops were about 4 inches high the horse hoe was run over them throwing up a ridge wider and flatter than the ordinary ridge used and not more than half as high. Otherwise than the cultivation the plots were treated the same as the check plots and harvesting was begun September 30 with the results shown below.

The yield on plot 2 is much below the others but this was apparently not due to the method of culture but to the soil. There was a strip of several rods on the upper part of this lot where the tubers were very scabby and only a light yield was obtained. This condition extended slightly into plot 3 reducing the yield of that plot somewhat but not nearly to such an extent as on plot 2. For this reason in a comparison plot 2 should be omitted.

Yield Per Acre for Each Plot. 1907.

No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Full ridge	Modified ridge	Full ridge	Modified ridge	Full ridge	Modified ridge
133.0 bbls.	85.9 bbls.	108 bbls.	112 bbls.	113.3 bbls.	129 bbls.

Average for full ridge culture..................	118 barrels
Average for modified ridge culture, all 3 plots....	109 barrels
Average for modified ridge culture, plots 4 and 6..	121 barrels

EXPERIMENT IN 1908.

For the modified culture experiment this year 90 rows, nearly three acres, were planted on new land on the northwest part of Mr. John Watson's farm in Houlton. The plan of planting in a solid piece instead of in strips as in 1907 was adopted for convenience in cultivating early in the season when it is desirable to run the weeder and smoothing harrow crosswise to keep down the weeds. Check acres for comparison were planted in the ordinary way, on either side of the piece planted by the modified culture method. The first check acre and 56 rows of the modified ridge culture plot were planted May 24 to 26, but on account of rain the remaining 34 rows and the other check acre were not planted until June 2. The Robbins planter was used to plant the field and for the modified ridge culture plot it was set to plant as deeply as possible the seed being on the average 3 inches below the surface of the ground after leveling the ridge off. As soon as the planting was completed the smoothing harrow was run crosswise to level off the ridges formed by the planter. A few days later the weeder was likewise run over the piece to destroy any weeds that were starting. On June 22 the rows first planted were up and the cultivator was run between them, followed by the weeder two days later. This method of culture was continued each week until the plants were about 6 inches high when the weeder was discontinued and the cultivator set wide so as to run as near the plants as possible was run over the piece twice a week. On July 7 the horse-hoe set wide so as to throw up only a low wide ridge was run over the piece. Work with the cultivator was continued and again on July 15 the horse-hoe was employed to disturb the earth around the plants and conserve the moisture. At this time the tops were getting large and cultivation was discontinued. July 20 the field was visited and the potatoes found to be growing finely, very free from weeds and apparently not suffering from the quite severe drought we were having. Sufficient rain, however, fell early in August to warrant a good crop with all kinds of culture. About September 15 killing frosts stopped further growth and digging was begun on the 18th. The yields were as follows:

	Merchantable Barrels.	Total Barrels.
High ridge check plot*	114	118
Modified ridge, 3 acres	328	341
High ridge check plot	97.5	101.5
Average for check plots	105.8	109.5
Average modified culture plots	109.3	113.3

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* The plots were strictly comparable as to area but were a little less than an acre each.

The averages for the 2 years (omitting plot 2 of 1907 experiment) are:

High ridge culture	114 barrels
Modified ridge culture	117 barrels

In these two seasons there was nothing to chose between the two methods so far as yield was concerned. It is planned to continue this experiment on the same farm in 1909.

A TEST OF BLIGHT RESISTANT VARIETIES OF POTATOES.

About 1903 Prof. William Stuart of the Vermont Experiment Station began a study of disease resistant potatoes. After some little progress had been made, the scope of the investigation was enlarged and extended in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture. In 1904, Prof. L. R. Jones, the Botanist of the Vermont Station was in Europe as special agent of the Department of Agriculture and made a study of the blight resistant varieties of potatoes that were in cultivation in England and on the continent particularly in Germany and Holland. A large number of the more promising varieties were brought to America and were grown for 3 years at the Vermont Experiment Station in cooperation with the Bureau of Plant Industry. Quite a number of American varieties were grown in comparison with the European varieties.

Twenty-seven of these varieties which seemed to be the most hopeful were sent to this Station in the Spring of 1908 for testing as to their disease resistance in the Maine climate. There was also grown in comparison with these, a selected Green Mountain which Mr. J. W. Lowell of Gardiner originated by selection over a period of several years. The numbers with the exception of that given to the Lowell Green Mountain are the original Vermont Station numbers.

The numbers included between 501 and 517 originated in Germany, 523 in Holland, the numbers between 540 and 597 were all of English origin, and the others are of American origin. The amount of seed that was sent varied so greatly (from 10 pounds to 120 pounds) that it was not practicable to grow these varieties for a yield test. They were therefore grown to study their blight resistant qualities and to form as one best might a judgment as to the value of the variety from the apparent crop yield, size, smoothness, general appearance and cooking qualities of the tuber.

The seed was planted May 18 and 19 on Mr. John Watson's farm, Houlton. Before planting all the seed was treated with formaldehyde gas for scab fungus. The seed of each variety was divided into two equal portions, and one portion of each kind was planted on a field which was not to be sprayed, and the other portion on a field which was to be sprayed with bordeaux mixture in the usual manner.

In the season of 1908, there was no late blight in the County but early blight was quite prevalent in some places and manifested itself on some of these potatoes. The crop was harvested September 24 and 25, 1908.

As a result of the test, 14 of the varieties have been discarded as unsuited to Maine. Seed has been saved of the following numbers,—506, 511, 512, 517, 540, 542, 594, 596, 602, 610, 736, 4229, 4517 and Lowell's Green Mountain. It is proposed to plant these both for blight resistance and for yield tests on the John Watson farm in the season of 1909. Each variety will be divided as in 1908 into two portions and part will be planted on a field that is to be sprayed and part in a field that is to be left unsprayed.

In the table which follows, there are given the notes and observations made during the season of 1908. The observations upon growth and upon the quality of tubers are made entirely upon the crop from the unsprayed field.

VARIETIES TESTED.

501 *Sophie.* Seed small white potatoes which being planted on the outside row did not have quite so good a chance as the others. Vines strong growing and showed very little injury and practically no early blight until frost. The yield was rather poor of small potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, rather wet. Flavor, good.

505 *Irene.* Seed received, 60 pounds small red potatoes. Vines were vigorous and showed very little injury from early blight. Yield small and rather inferior potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, very good.

506 *Professor Maerker.* Strong grower, vines showed very little injury, some tip burn but no early blight until very last of season. A good yield of large white tubers.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, very good.

507 *Silesia.* Vines grew vigorously until about middle of August, showing no injury. About August 11 they showed some tip burn. On August 20 they showed considerable injury and some early blight but continued green until frost. Quite good yield medium sized white potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, fairly dry. Flavor, good.

508 *Max Eyth.* Very healthy and vigorous grower, showing very little injury from early blight or tip burn. Yield light, rather small red potatoes.

509 *Mohort.* Began to show early blight and tip burn August 8 and by August 20 showed considerable blight. The vines however were vigorous and a part of the tips kept green until frost came. Gave fair yield of medium sized white potatoes.

Cooking test: Baked, rather soggy. Flavor, not very good; rather strong.

511 *President Kruger.* On August 8 the vines showed some tip burn and August 20 considerable early blight. They were large and vigorous however and a part of the tops remained green until killed by frost. Yield was fairly good, medium sized round white potatoes.

Cooking test: Baked, quite dry; fine grained. Flavor, good.

512 *Professor Wohltmann.* Vines were quite vigorous growers but showed more or less tip burn and some early blight. Gave fair yield of medium sized red potatoes.

Cooking test: Baked, not very dry. Flavor, good.

516 *Fuerst Bismark.* Showed some tip burn and early blight on August 8 and considerable on August 20 but some of the vines kept green until frost.

Cooking test: Baked, quite dry and mealy. Flavor, quite good.

517 *Appollo.* Large white good looking potatoes. Good yield.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

523 *Daisy.* Very strong and healthy. Showed practically no blight. Vine very green when frost came. Lot of small potatoes not ripe. Too late for this climate.

540 *Factor.* Good strong vines showing very little blight. Good yield large white potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

542 *Langworthy.* Good strong growing vines that showed no injury until late in the season when some early blight was noticeable. September 1 a larger part of the tops remained green and tubers growing until frost killed the vines. Yield fair of medium sized white potatoes.

594 *Evergood.* On August 8 this variety showed some vine injury and on August 20 considerable injury and early blight which continued to increase to end of season. Somewhat reducing the yield. Fair yield of small white potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, not very dry. Flavor, good.

595 *Goodfellow.* A strong vigorous grower and showed very little vine injury until the very last of the season. It was affected by the light early frosts and had some early blight. Small yield of medium to small white potatoes.

Cooking test: Boiled, quite mealy. Baked, rather wet. Flavor, fair.

596 *Up-to-date.* Strong, vigorous grower and showed practically no injury until frost. A large yield of good sized smooth white round potatoes.

Cooking test: Boiled, fairly dry. Baked, not quite as good. Flavor, quite good.

597 *North Star.* Vines quite healthy and vigorous but showed some injury and early blight on August 20. Vines mostly remained green until frost. Yield not very good. Potatoes small, not ripe and clinging to the vines. Too late for this climate.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

602 *Cambridge Russet.* On August 8 this variety showed some tip burn but was quite healthy. On August 20 it showed very little early blight but on August 28 it showed a good deal of early blight and the two rows could be easily detected on the unsprayed plot while the sprayed was green. On September 9 vines were dead but on sprayed portion still green. Yield fairly good, medium sized white potatoes. The potatoes were larger and better on the sprayed plot than the unsprayed.

Cooking test: Boiled, dry and mealy. Baked, dry and mealy. Flavor, very good.

610 *Blight Proof.* Vines very healthy and showed very little injury up to coming of frost. Fair yield of large round and handsome potatoes. A desirable variety.

Cooking test: Boiled, dry and mealy. Baked, dry and mealy. Flavor, very good.

617 *Late Blightless.* Tops vigorous and showed very little injury. Yield fair but not ripe. Potatoes rather small. Too late for this climate.

637 *Alexander No. 1.* Vines healthy and vigorous, large top. Yield good, of good sized red potatoes but not very ripe.

652 *Professor Maerker.* Vines vigorous and strong; showed very little injury. Yield not very large. Potatoes white, medium size, not ripe, clinging to vines.

Cooking test: Boiled, fair quality. Flavor fair.

736 *Smith's Blight Proof.* Showed a little early blight last of the season but generally healthy. Fair yield good sized white potatoes.

Cooking test: Boiled, only fairly good. Baked, only fairly good. Flavor, fair.

4229 *Lawrence Seedling.* Tops were vigorous and strong and showed very little injury from early blight. Yield very large, round reddish-colored potatoes. A desirable potato except for color and its deep eyes.

Cooking test: Boiled, dry and mealy. Baked, dry and mealy. Flavor, good.

4518 *Rust Proof.* Vines remained vigorous and showed very little early blight up to time of frost. Yield good, large round white potatoes.

Cooking test: Boiled, quite mealy. Baked, quite mealy. Flavor, fair.

28 *Lowell's Green Mountain.* The vines remained nearly free from any injury and were very little affected by early blight. It suffered less than unselected Green Mountains which were sprayed. Yield was good on both the sprayed and the unsprayed.

Cooking test: BBoiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

Target Brand Fungicide on Potatoes.

At the request of the Horticultural Distributing Company of Martinsburg, W. Va., the Station undertook an experiment with potatoes in which the Target Brand Fungicide was to be used in the place of the Regular Bordeaux Mixture.

The following were the essential points in the agreement which were entered into between the Expriment Station and the Company.

Three-acre strips shall be used in the experiment. These plots shall be adjoining each other. The character of soil, preparation (including fertilizer), planting, cultivation, etc., shall be uniform on all three plots except: Plots A and C shall be sprayed with Regular Bordeaux Mixture and on same dates Plot B shall be sprayed with Target Brand Fungicide.

The Bordeaux Mixture and the Target Brand Fungicide will both be applied with a Watson Improved 4-rowed automatic sprayer and so far as possible, equal number of gallons of each shall be applied per acre and on same dates.

The Director of the Maine Agricultural Experiment Station personally or by a competent representative shall supervise all the work, including spraying and harvesting.

The American Horticultural Distributing Company may send a representative to observe any or all of the details of the experiments.

The American Horticultural Distributing Company shall deliver free of charge at Houlton, Maine the fungicide necessary for use on Plot B and shall deposit with the Houlton Trust Company of Houlton, Maine, one hundred and twenty-five ($125) dollars to be paid in part or entirely to the owner of the field when the experiment is concluded provided injury is done to the potatoes which injury is due to the use of the Target Brand Fungicide.

Whether or not there is injury shall be determined:

(a) If the yield of merchantable potatoes upon plot B shall be less than the average yield (Plots A plus C ÷ 2) upon plots A and C, the injury shall be in proportion to the decrease in yield at market price in Houlton on December 1, 1908.

(b) If the quality of the potatoes grown upon Plot B shall be inferior so as to affect the market value, the injury shall be considered as due to the fungicide and the financial loss shall be decided by one or three of the large buyers of potatoes in Houlton.

In any case the Station shall have the right, if it desires, to publish the results of the experiment.

The following letter was sent October 6, 1908 to the company reporting the results of the experiment:—

"We have harvested the potatoes on the acre upon which fungicide was used and upon the two acres grown upon either side. There was no late blight in the county this year. You may remember that the Target Brand Bordeaux which you sent to us was not received until very nearly time to use it and in consequence of this it was impossible for us to use the Quick Bordeaux which you sent to us, and the experiment was wholly with the Target Brand Fungicide and did not include the Quick Bordeaux. The yields were as follows:—

Fungicide plots:	merchantable potatoes	103 barrels
	small potatoes	6 barrels
	Total	109 barrels
Check plot to the south:	merchantable	122 barrels
	small	5 barrels
	Total	127 barrels

Check plot to the north:	merchantable	118 barrels
	small	4 barrels
	Total	122 barrels

The average merchantable potatoes on the two check plots was 120 barrels; and on the fungicide 103 barrels or a decrease in yield, which in my judgment is entirely due to the fungicide, of 17 barrels. The areas north and south of the fungicide were sprayed with Bordeaux and on the same days on which the fungicide was applied. Sprayings were made every 10 days during the growing season, beginning early in July.

As I stated above, there was no late blight in the County. Early in August, the fungicide plots began to show signs of vine injury and later they developed a good deal of early blight. The field sloped gently to the East so that the field was in sight as one drove on to the farm, for perhaps half a mile, and there was no time after the 10th of August but what anyone could have picked out the fungicide plot at that distance. In my judgment the decreased yield was due to this vine injury, and to its failure to protect from early blight as thoroughly as Regular Bordeaux Mixture."

ALFALFA.

The Station began experimenting with alfalfa in 1903. The reports for the work of the year 1904-5 are given on pages 35 and following of bulletin 126. A number of cooperative experiments were entered into in 1906, with seed specially furnished by the Bureau of Plant Industry of the U. S. Department of Agriculture; and at the same time three-quarters of an acre was planted with the same seed by the Experiment Station on the farm of John Watson at Houlton. A number of the experimenters reported that they obtained a fair stand and in some instances the alfalfa went through the winter of 1906-7 in very good shape. So far as we have been able to learn by correspondence, however, in no case was a permanent stand obtained.

The experimental field at Houlton gave the best stand of any that has been obtained in the State, so far as the writers know. Notes made in September 1906 show that the field was in good shape, there was a very uniform stand that had been cut twice with an estimated yield of 1¼ tons in the two cuttings. At that date it stood from 12 to 16 inches high and seemed to be in excellent shape for going into the winter, with the exception that here and there through the piece were occasional plants effected with the leaf spot of alfalfa,—*Pseudepeziza medicaginis.* The alfalfa went through the winter of 1906-7 in good shape and in the year 1907 three cuttings were made, and in the fall of 1907 the piece was still looking in very good shape. The leaf spot of alfalfa had not gained any on the field and the plants were, for the most part, free from disease. There was in the winter of 1907-8 an unusual amount of ice, with the result that the alfalfa was entirely smothered out and in the spring of 1908 there were only a few plants alive on the field. The Station has made no further experiments in the growing of alfalfa and is not likely to in the near future.

It is to be remembered, however, that although there have been hundreds of attempts in Maine to grow alfalfa and that thus far no permanent success has been obtained, that negative results do not reach to positive conclusions, and it may be that some one will find a method of growing this valuable crop that will be applicable to Maine conditions. There, however, can be no hope of success unless pains are taken to inoculate the soil with the bacteria which produce the root nodules whereby the alfalfa plant, like other legumes, is able to acquire atmospheric nitrogen. It is probable that this inoculation can only surely be accomplished by obtaining soil from alfalfa fields where the nodules are abundant. The culture method of inoculation is still in the experimental stage and cannot, so far as the writers know, be relied upon. Another seeming requisite is an abundance of lime and if alfalfa is to be successfully grown, the field will have to be heavily limed. Land that will grow clover luxuriantly will not of necessity carry lime enough for alfalfa plants.

The following quoted from bulletin 126 seems to be as pertinent now as when it was written :—

In order for alfalfa to be of value to Maine agriculture a good stand must be obtained and the stand must be able to continue not one, but several years. The Station does not advice anyone in this State to grow alfalfa at present except in an experimental way. That alfalfa would be a valuable addition to our forage crops needs no demonstration. If the difficulties which thus far have prevented its successful culture can be surmounted, it will more than recompense the cost of the many hundreds of trials that have been given this plant in Maine during the past 25 years.

Wild Mustard.

During several years, beginning with 1904, the writers endeavored to kill wild mustard in sown grain crops by spraying with copper sulphate and with iron sulphate. The first season's experiment was markedly successful. The second year an attempt was made to repeat the experiment on a large scale in Aroostook County and while the plants were stunted it did not result in destroying the weed. While it has been generally recognized throughout the State that wild mustard or charlock is one of Maine's worst weeds in sown crops it is not generally known and was not known to the writers in 1905 that there are two plants which differ so little in appearance that they are both known as wild mustard. One of these is the wild mustard proper, *Sinapsis arvensis,* which is also frequently and properly called "charlock." The weed which very closely resembles it and is sometimes called jointed or white charlock is the wild radish, *Raphanus raphanistrum.* Young wild mustard plants are readily killed by spraying with a solution of either copper sulphate or iron sulphate. The wild radish is very resistant and in experiments made at this Station has even defied treatment with 20 per cent solution of iron sulphate reinforced with 5 per cent of sulphuric acid. In the first year's experiments conducted on the College Farm at Orono the weed that was killed was wild mustard. In the second year's experiments in Aroostook County the failure to kill was due to the weed being wild radish.

It is perfectly possible to kill wild mustard by spraying. The only discouraging thing about spraying for wild mustard in Maine is that so much that is commonly called wild mustard is wild radish, and while it has been claimed by investigators in Germany and France that they have killed wild radish by spraying with a 20 per cent solution of iron sulphate, it is more than probable that they were wrong in identifying the plant.

TO KILL WILD MUSTARD.

If one desires to kill wild mustard (not wild radish) it can be readily accomplished in seeded crops without injury to the grain or grass by spraying with a 20 per cent solution of iron sulphate. A power sprayer on the same general plan as a potato sprayer should be used.

The solution is readily made as follows: Empty a 100 pound sack of granulated iron sulphate into an oil barrel (which will hold about 50 gallons). Fill the barrel up with water and stir vigorously for a few minutes until the sulphate goes into solution. The solution can be put into the spray tank and used at once, or it can be kept in the barrel until the desired time for use. Iron sulphate solution is not poisonous and can be handled without fear; white clothing coming in contact with it, however, will be discolored by iron stains.

The spraying should be made on a calm, bright day after the dew has disappeared. If rain follows within a few hours the spraying is not as effective. The grain fields should be sprayed when the mustard plants are in the third leaf and before the plants are in blossom. If sprayed after the plants are in bloom, it will kill the leaves but will not prevent the formation of seed.

Lime in Seeding Down.

During the past few years in many fields and in different localities marked improvements have been made upon certain crops, particularly the yield of legumes, by the liberal application of lime. There are undoubtedly thousands of acres in Maine that would be benefited by an occasional liberal application of lime, so far as clover and certain other crops are concerned.

There is probably no one money crop of greater importance in Maine than the potato. Not only does Aroostook County grow many millions of bushels each year but potato growing is now practiced successfully in other sections of the State on a large commercial scale. It has been learned how to control the ordinary fungus diseases which result in the killing of the tops and the loss of crop from premature ripening, or from rot. In potato culture the most serious obstacle at present is potato scab. This is a fungus disease and seems to grow best in the presence of an alkali. In order to study the effect of liming soils upon the development of scab in a potato crop* it was deemed best to use the lime as one would in ordinary farm practice. For this purpose a field was treated with lime and after the grain and grass crops had been removed it was experimented with for 2 years as regards the development of scab upon potatoes. The effect upon potatoes has been reported.*

An experiment upon another field was begun in 1907 on which it is proposed to follow up the effect of lime upon the development of scab on potatoes. On this field smaller amounts of lime were used than on the Watson field to see if the beneficial effect of the lime might be had and at the same time not introduce soil conditions favorable to the growth of the scab fungus. There is here reported the effect of lime upon the grain crop and the legumes when it was applied at the time of seeding down. It is planned to test the effect upon the potato crop in 1909 and 1910.

ON WATSON FARM.

The piece of land used for the purpose was on Mr. John Watson's farm in Houlton, and had been in potatoes two years, receiving about 1200 lbs. of high grade fertilizer to the acre each year. After plowing it also received a liberal coat of stable manure. When seeded in 1905 it was divided into plots of one-half acre each and 300 lbs. of a complete fertilizer were added to each plot. To plots Nos. 2 and 6 were added 500 lbs. of lime and Nos. 4 and 8, 1000 lbs. of lime to each plot which was harrowed in before the grain was sowed.

The lime seemed to have little or no effect on the oat crop and the yields of the different plots were not kept separate but the clover growing in 1906 showed a marked difference between the plots that were limed and those that were not limed. The clover plants were much longer and greener and lines between them and the plots not limed were very plain. The greatest difference was on the higher and dryer portions of the field. The ends of the plot that were low and moist showed but little difference in appearance of yield. The following is the yields estimated when the hay was loaded on to the racks.

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* See Bulletin 140 this Station, p. 4.

*Estimated Yield of Hay.**

Plot No. 2* 500 lbs. lime	3,000 lbs.
Plot No. 3, no lime	1,500 lbs.
Plot No. 4, 1,000 lbs. lime	2,600 lbs.
Plot No. 5, no lime	1,300 lbs.
Plot No. 6, 500 lbs. lime	2,800 lbs.
Plot No. 7, no lime	2,300 lbs.
Plot No. 8, 1,000 lbs. lime	3,000 lbs.
Plot No. 9, no lime	2,300 lbs.

While the above figures are not strictly accurate they show quite closely the difference in yields. If a few rods of one end of the plot that was low and moist had been left out the difference would have been still greater, for certainly on the dryer portions of the field the yield of the limed plots was at least 4 times that of the others.

ON THE EDBLAD FARM.

In 1907 a second experiment with lime was begun on the farm of Mr. H. Edblad of Houlton.

The experiment covered 6 plots of one acre each. The lime was applied with a fertilizer distributor at the time of seeding the field in 1907 to oats, grass and clover. All plots were treated alike except that to No. 1 was added 1000 lbs. agricultural lime, No. 2, no lime, No. 3, 750 lbs. lime, No. 4, no lime, No. 5, 500 lbs. lime. There was no appreciable effect on the yield of grain (oats) and straw.

The winter of 1907 and 1908 was open with very little snow, consequently much of the clover killed out. Plot No. 1 was on lower ground than the others, was better covered with snow during the winter, and being more moist suffered less from the dry weather of the summer of 1908 than the other plots. There was a very good stand of clover all over this plot. On all the other plots the clover was killed out in spots making the stand somewhat uneven. The plots were harvested July 21-22 when the clover was in bloom.

The yields estimated while loading were as follows:—

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* Half acre plots.

*Estimated Yield of Hay.**

No. 1*, 1,000 lbs. lime applied	5,300 lbs.
No. 2, no lime applied	3,200 lbs.
No. 3, 750 lbs. lime applied	4,400 lbs.
No. 4, no lime applied	3,000 lbs.
No. 5, 500 lbs. lime applied	3,250 lbs.

It is clear that in these cases the application of lime materially increased the yield of clover, and it is probable that in many places where clover has not been successfully grown, that the application of lime might prove a remedy.

It is, however, a question whether in a State which is so largely dependent upon the potato as a money crop, as is Maine, whether it be wise to use lime in connection with crops until the question of the scab fungus has been more thoroughly worked out and the methods of controlling it further developed, and particularly it is learned how to fight it after a soil is once infested. It is an open question whether it is not better policy to have smaller yields of legumes and keep the soil somewhat acid, in order to make the conditions for the development of potato scab as little favorable as possible. In the experiments here reported, there is apparently no special benefit from the lime upon the grain crop or upon the ordinary English grasses, but it proved to be beneficial on the legumes. To Maine farmers who make potato growing an essential feature of their business it is suggested that if they use lime, they do so in an experimental way at the rate of perhaps 500 pounds to the acre, and that they carefully note the effect upon the yield of clover and the development of scab.

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* Acre plots.